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(54) **Compositions containing fat-soluble substances in a carbohydrate matrix**

Zusammensetzung, die fettlösliche Substanzen in einer Kohlenhydratmatrix enthält

Composition contenant des substances solubles dans la graisse dans une matrice de glucides

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Description

[0001] The present invention relates to compositions comprising fat soluble substances in a glassy carbohydrate matrix, to a process for their manufacture and to their use to enrich food and feed.

[0002] Water soluble compositions of fat soluble vitamins play an important role in the field of human and animal nutrition. Such compositions are usually marketed in the form of emulsions or dry powders. It is a common feature in such compositions that the fat soluble vitamins are usually protected with a matrix component, e.g. a gelatin matrix.

[0003] Stable vitamin compositions have also been conventionally obtained by a method wherein the vitamins are encapsulated in matrixes in the form of a powder. Products on the market are e.g. vitamin A palmitate encapsulated in a CAPSUL® matrix, available under the name Vitamin A Palmitate 250 SD by F. Hoffmann-La Roche AG and vitamin A palmitate encapsulated in a gelatin matrix, available under the name Vitamin A Palmitate 250 CWS by F. Hoffmann-La Roche AG.

[0004] WO 89/08988 discloses a composition having an oil/fat soluble vitamin in a carbohydrate matrix.

[0005] All the products on the market are sensitive to air, heat, light and humidity. Thus, there is a constant need to improve the stability under regular storage conditions. Accordingly, the problem addressed by the present invention was to find compositions comprising fat soluble substances showing an improved storage stability.

[0006] It has now been found that the stability can be improved by encapsulating one or more fat soluble substances in a glassy low-molecular weight carbohydrate matrix.

[0007] Thus, the invention relates to a composition comprising in percents by weight based on the total weight of the composition

from about 1 wt% to about 40 wt% of a fat soluble substance encapsulated in a carbohydrate matrix composed of maltose or maltose syrup, or a mixture of low-molecular weight carbohydrates, optionally in combination with a high-molecular weight carbohydrate; from about 0.1 wt% to about 30 wt% of an emulsifier; and, optionally, from about 0.1 wt% to about 15 wt% of an antioxidant.

[0008] The fat soluble substances include fat soluble vitamins selected from the group consisting of vitamins A, E, D and K and derivatives thereof; carotenoids such as e.g. beta-carotene, astaxanthin, apocarotenal, canthaxanthin, apoester, citranaxanthin and zeaxanthin; polyunsaturated fatty acids as well as mixtures thereof. Particularly interesting products contain fat soluble vitamins, preferably vitamin A and its derivatives, especially vitamin A acetate or vitamin A palmitate. If the composition comprises a fat soluble vitamin it is advantageous to add an antioxidant. Thus, a preferred composition comprises in percents by weight based on the total weight of the composition from about 1 wt% to about 40 wt% of a fat soluble vitamin encapsulated in a carbohydrate matrix composed of maltose or maltose syrup, or a mixture of low-molecular weight carbohydrates, optionally in combination with a high-molecular weight carbohydrate; from about 0.1 wt% to about 30 wt% of an emulsifier; and from about 0.1 wt% to about 15 wt% of an antioxidant.

[0009] Preferred examples of polyunsaturated fatty acids are selected from the group consisting of arachidonic acid (AA), docosahexaenic acid (DHA) or eicosapentaenic acid (EPA).

[0010] Low-molecular weight carbohydrates include mono- and di-saccharides such as e.g. fructose, glucose, glucose syrup, sucrose, lactose, dextrose, maltose, high-maltose solid (syrup), xylose, arabinose, ribose and sugar alcohols. Especially preferred are fructose, glucose, glucose syrup, maltose and sucrose. Maltose can be used also in the form of high-maltose solid (syrup) which contains over 50 wt% of maltose.

[0011] The low-molecular weight carbohydrates are used at a level of about 30 wt% to about 95 wt%, preferably of about 50 wt% to about 85 wt%, more preferably about 70 wt%.

[0012] High-molecular weight carbohydrates include e.g. maltodextrin, which is used at a level of 0 wt% to about 50 wt%, preferably about 10 wt% to about 40 wt%, more preferably about 30 wt%.

[0013] Maltodextrin can be obtained from Grain Processing Corp. under the trade name MALTRIN.

[0014] Suitable emulsifiers are polyoxyethylene-sorbitan-fatty acid esters; e.g. mono- and tri-lauryl, palmityl, stearyl and oleyl esters; especially those available under the tradename TWEEN (for example TWEEN 80, TWEEN 60, TWEEN 40, TWEEN 20) from ICI, chemically modified starch obtainable from National Starch & Chemical Company under the tradename CAPSUL and HI-CAP, and ascorbyl palmitate.

[0015] Suitable antioxidants are selected from the group consisting of sodium ascorbate, ascorbyl palmitate, dl-α-tocopherol, mixed tocopherols, lecithin, butylated hydroxy toluene (BHT), butylated hydroxy anisole (BHA) and mixtures thereof. Preferred are sodium ascorbate, ascorbyl palmitate, dl-α-tocopherol, mixed tocopherols and lecithin.

[0016] The antioxidants can be added either to the aqueous phase and/or to the lipid phases. Sodium ascorbate is preferably added to the aqueous phase. Ascorbyl palmitate and/or dl-α-tocopherol are preferably added to the lipid phase.

[0017] The compositions in accordance with the invention can be manufactured, in principle, by preparing an oil in water emulsion containing from about 1 wt% to about 40 wt% of a fat soluble substance; from about 30 wt% to about 85 wt% of maltose or a mixture of low-molecular weight carbohydrates optionally in combination with 0 wt% to about 50 wt% of a high-molecular weight carbohydrate; from about 0.1 wt% to about 30 wt% of an emulsifier; and, optionally,

from about 0.1wt% to about 15wt% of an antioxidant; and, if desired, converting this emulsion into a dry powder.

[0018] It is self evident that the total amount of the ingredients is not beyond 100wt%.

[0019] Generally the low-molecular weight carbohydrates optionally in combination with high-molecular weight carbohydrates are first dissolved in water. It is advantageous to carry out this process step at a temperature in the range of about 20°C to about 90°C, preferably about 40°C to about 75°C. Then the antioxidant and the emulsifier are added. The so called carbohydrate matrix is obtained in this manner. Then, the fat soluble substance or a mixture of several such substances is mixed with an antioxidant, if desired, and the resulting mixture is gradually added to the aqueous phase while the mixture is homogenized with a mixer to form an oil in water emulsion. The procedure can be carried out readily at temperatures of about room temperature to about 80°C, preferably at about 30°C to about 50°C, more preferably about 40°C.

[0020] The conversion of a thus-manufactured emulsion into a dry powder can be effected by methods known in the art e.g. by spray drying.

[0021] The compositions in accordance with the invention show an excellent stability at temperatures up to 35 °C and show a better stability under humid condition. The use of a low-molecular weight sugar mixture prevents sugar crystallization from the sugar glass matrix and thus, the stability of the fat soluble substance, particularly the stability of fat soluble vitamins under humid stress conditions is improved.

[0022] The compositions in accordance with the invention can be used for multivitamin tablets, hard gelatin capsules and dry food and feed compositions.

[0023] Furthermore, the composition can be mixed directly without using any adhesive with sugar, e.g. with sucrose. This is an essential advantage as the prior art products Vitamin A Palmitate 250 SD or Vitamin A Palmitate 250 CWS require the use of oil as an adhesive to ensure homogeneity and no segregation.

[0024] To enrich sugar it is advantageous to prepare a premix by mixing sugar and the dry powder of the composition according to the invention in a ratio of about 14 to 1 to about 4 to 1. The sugar crystals are preferably wetted before being added to the dry powder by adding a small amount of a saturated sucrose solution or of water. To reduce its hygroscopicity it is advantageous to coat the premix with an anticaking agent such as silicic acid or with silicate by simply shaking the premix with the anticaking agent. The anticaking agent is added in an amount of about 0.2 wt% to about 2 wt%.

[0025] The present invention is illustrated by the following examples:

Example 1

[0026] Starch sodium octenyl succinate (84.0 g; CAPSUL from National Starch & Chemical, Bridgewater, NJ) was dissolved in water (402 g) and heated to 65 °C. Sucrose (461.5 g) and maltodextrin (243.1 g; MALTRIN M100; Grain Processing Corp., Muscatine, Iowa) were then dissolved in the starch solution and the temperature was held at about 65 °C. Sodium ascorbate (15 g) was then added to the sucrose solution and the solution was held at 40 °C. Water lost due to evaporation was made up before homogenization with the lipid phase. A mixture of vitamin A palmitate (179.6 g), dl-α-tocopherol (15.75 g) and ascorbyl palmitate (15.75 g) was stirred and heated to 40 °C and then stirred at said temperature for about 15 minutes. The lipid phase mixture (201 g) was then gradually added to the sucrose solution and homogenized under nitrogen with a homogenizer (Gifford-Wood homogenizer) to yield an emulsion having a particle size of approximately 0.2-1.5 microns. The viscosity of the emulsion was adjusted with additional water, if necessary. The emulsion was spray-dried (Niro Atomizer, Copenhagen, Denmark) to give a powder.

Example 2

[0027] Starch sodium octenyl succinate (84.0 g; CAPSUL from National Starch & Chemical, Bridgewater, NJ) was dissolved in water (374 g) and heated to 65 °C. Maltose (368.2 g) and maltodextrin (364.7 g; MALTRIN M100; Grain Processing Corp., Muscatine, Iowa) were dissolved in the starch solution and the temperature was held at about 65 °C. Sodium ascorbate (15 g) was then added to the sucrose solution and the solution was held at 40 °C. Water lost due to evaporation was made up before homogenization with the lipid phase. A mixture of vitamin A palmitate (179.6 g), dl-α-tocopherol (15.75 g) and ascorbyl palmitate (15.75 g) was stirred and heated to 40 °C and then stirred at said temperature for about 15 minutes. The lipid phase mixture (201 g) was then gradually added to the sucrose solution and homogenized under nitrogen with a homogenizer (Gifford-Wood homogenizer) to yield an emulsion having a particle size of approximately 0.2-1.5 microns. The viscosity of the emulsion was adjusted with additional water, if necessary. The emulsion was spray-dried (Niro Atomizer, Copenhagen, Denmark) to give a powder.

Example 3

[0028] Starch sodium octenyl succinate (84.0 g; CAPSUL from National Starch & Chemical, Bridgewater, NJ) was

dissolved in water (366 g) and heated to 65 °C. Sucrose (69.2 g), Glucose syrup (88 g), maltose (73.6 g), glucose (76.0 g), fructose (69.2 g) and maltodextrin (364.7 g; MALTRIN M100; Grain Processing Corp., Muscatine, Iowa) were dissolved in the starch solution and the temperature was held at about 65 °C. Sodium ascorbate (15 g) was then added to the sucrose solution and the solution was held at 40 °C. Water lost due to evaporation was made up before homogenization with the lipid phase. A mixture of vitamin A palmitate (179.6 g), dl-α-tocopherol (15.75 g) and ascorbyl palmitate (15.75 g) was stirred and heated to 40 °C and then stirred at said temperature for about 15 minutes. The lipid phase mixture (201 g) was then gradually added to the sucrose solution and homogenized under nitrogen with a homogenizer (Gifford-Wood homogenizer) to yield an emulsion having a particle size of approximately 0.2-1.5 microns. The viscosity of the emulsion was adjusted with additional water, if necessary. The emulsion was spray-dried (Niro Atomizer, Copenhagen, Denmark) to give a powder.

Example 4

[0029] Starch sodium octenyl succinate (84.0 g; CAPSUL from National Starch & Chemical, Bridgewater, NJ) was dissolved in water (377 g) and heated to 65 °C. Sucrose (115 g), maltose (122.3 g), glucose (126.2 g) and maltodextrin (364.7 g; MALTRIN M100; Grain Processing Corp., Muscatine, Iowa) were dissolved in the starch solution and the temperature was held at about 65 °C. Sodium ascorbate (15 g) was then added to the sucrose solution and the solution was held at 40 °C. Water lost due to evaporation was made up before homogenization with the lipid phase. A mixture of vitamin A palmitate (179.6 g), dl-α-tocopherol (15.75 g) and ascorbyl palmitate (15.75 g) was stirred and heated to 40 °C and then stirred at said temperature for about 15 minutes. The lipid phase mixture (201 g) was then gradually added to the sucrose solution and homogenized under nitrogen with a homogenizer (Gifford-Wood homogenizer) to yield an emulsion having a particle size of approximately 0.2-1.5 microns. The viscosity of the emulsion was adjusted with additional water, if necessary. The emulsion was spray-dried (Niro Atomizer, Copenhagen, Denmark) to give a powder.

Example 5

(Stability Evaluation)

[0030] Each sample prepared as described in Examples 1-4 was mixed sucrose (cane sugar) in a ratio of 1 to 4. The mixture was then stored in sealed polyethylene bags at 37 °C/75% relative humidity for vitamin A stability evaluation. The % Vitamin A palmitate retentions at various time intervals are shown in the following Table 1. It shows that the samples prepared with maltose only (Example 2) or with a mixture of low molecular weight carbohydrates (Example 3 and 4) according to the invention have over-all good stability, whereas the sample prepared with sucrose only (Example 1) shows a sudden loss of vitamin A after 1.5-month storage, which significantly reduces the shelf-life of the product.

Table 1

	Example 1	Example 2	Example 3	Example 4
Sucrose	46.15	0	6.92	11.5
Maltose	0	34.61	6.92	11.5
Glucose syrup	0	0	6.92	0
Glucose	0	0	6.92	11.5
Fructose	0	0	6.92	0
Maltrin M100	23.07	34.61	34.61	34.61
Capsul	7.69	7.69	7.69	7.69
Vitamin A Palmitate	17.1	17.1	17.1	17.1
Sodium Ascorbate	1.5	1.5	1.5	1.5
α-DL-Tocopherol	1.5	1.5	1.5	1.5
Ascorbyl Palmitate	1.5	1.5	1.5	1.5
Water	(1.5)	(1.5)	(1.5)	(1.5)

Table 1 (continued)

	Example 1	Example 2	Example 3	Example 4
Total	100	100	100	100
% Vitamin A Retention at 37 °C/75% RH				
Initial	100	100	100	100
0.5 months	99.1	89.8	91.2	94.2
1.0 months	104	99.0	96.6	105
1.5 months	100	92.7	94.1	94.0
2.0 months	0	92.9	99.2	87.7
2.5 months	0	86.7	55.9	52.8
3.0 months	0	73.9	54.2	47.8

Example 6

[0031] Preparation of a sugar premix containing silicic acid.

[0032] Starch sodium octenyl succinate (84 g; CAPSUL from National Starch & Chemical, Bridgewater, NJ) was dissolved in water (379 g). Sucrose (115.4 g), maltose (120.2 g), glucose (126.6 g), fructose (122.7 g) and maltodextrin (243.1 g; MALTRIN M100; Grain Processing Corp., Muscatine, Iowa) were dissolved in the starch solution and the temperature was raised to about 65 °C. Sodium ascorbate (15 g) was then added to the sucrose solution and the solution was held at 40 °C. Water lost due to evaporation was made up before homogenization with the lipid phase. A mixture of vitamin A palmitate (188.1 g), dl-α-tocopherol (16.5 g) and ascorbyl palmitate (16.5 g) was stirred and heated to 40 °C and then stirred at said temperature for about 15 minutes. The lipid phase mixture (201 g) was then gradually added to the sucrose solution and homogenized under nitrogen with a homogenizer (Gifford-Wood homogenizer) to yield an emulsion having a particle size of approximately 0.2-1.5 microns. The viscosity of the emulsion was adjusted with additional water, if necessary, and the emulsion was spray-dried (Niro Atomizer, Copenhagen, Denmark) to give a powder.

[0033] A saturated sucrose solution was prepared by dissolving sucrose (100 g) in water (50 g). The saturated sucrose solution (15 g) was added to sucrose crystals (600 g) and then mixed until the crystals were evenly wetted. The wet crystals (615 g) were gradually added to the spray-dried powder (150 g) prepared as described above while the mixture was gently mixed. The mixture was dried in a desiccator over the weekend and then equilibrated in a desiccator containing calcium chloride (about 30% relative humidity). The mixture (490 g) was then coated with silicic acid (7.35 g) by shaking with silicic acid to reduce its hygroscopicity.

Claims

1. A composition comprising in percents by weight based on the total weight of the composition
   from 1 wt% to 40 wt% of a fat soluble substance encapsulated in a carbohydrate matrix composed of maltose or maltose syrup, or a mixture of low-molecular weight carbohydrates, optionally in combination with a high-molecular weight carbohydrate;
   from 0.1 wt% to 30 wt% of an emulsifier; and, optionally,
   from 0.1 wt% to 15 wt% of an antioxidant.

2. A composition according to claim 1, wherein the carbohydrate matrix is composed of a mixture of low-molecular weight carbohydrates in combination with a high-molecular weight carbohydrate.

3. A composition according to claims 1 or 2, wherein the low-molecular weight carbohydrates are selected from the group consisting of fructose, glucose, glucose syrup, sucrose, lactose, dextrose, maltose, high-maltose solid (syrup) containing over 50 wt% of maltose, xylose, arabinose, ribose and sugar alcohols.

4. A composition according to claims 1 or 2, wherein the low-molecular weight carbohydrates are selected from the group consisting of fructose, glucose, glucose syrup, maltose and sucrose.

5. A composition according to claim 1, wherein the carbohydrate matrix is composed of maltose or high-maltose solid (syrup) containing over 50 wt% of maltose, in combination with a high-molecular weight carbohydrate.

6. A composition according to any one of claims 1 to 5, wherein the high-molecular weight carbohydrate is maltodextrin.

7. A composition according to claim 1 to 6, wherein the fat soluble substance is a fat soluble vitamin selected from the group consisting of vitamins A, E, D and K and derivatives thereof, a carotenoid, a polyunsaturated fatty acid as well as mixtures thereof.

8. A composition according to of claim 7, wherein the vitamin A derivative is vitamin A acetate or vitamin A palmitate.

9. A composition according to claim 7, wherein the carotenoid is selected from the group consisting of beta-carotene, astaxanthin, apocarotenal, canthaxanthin, apoester, citranaxanthin and zeaxanthin.

10. A composition according to claim 7, wherein the polyunsaturated fatty acid is selected from the group consisting of arachidonic acid (AA), docosahexaenic acid (DHA) or eicosapentaenic acid (EPA).

11. A composition according to any one of claims 1 to 10, comprising from .30 wt% to 95 wt%, preferably from 50 wt% to 85 wt%, more preferably about 70 wt% of low-molecular weight carbohydrate.

12. A composition according to any one of claims 1 to 11, comprising from 0 wt% to 50 wt%, preferably from 10 wt% to 40 wt%, more preferably about 30 wt% of high-molecular weight carbohydrate.

13. A composition according to any one of claims 1 to 12, wherein the emulsifier is a polyoxyethylene-sorbitan-fatty acid ester, a chemically modified starch or ascorbyl palmitate.

14. A composition according to any one of claims 1 to 13, wherein the antioxidant is selected from the group consisting of sodium ascorbate, ascorbyl palmitate, dl-α-tocopherol, mixed tocopherols, lecithin and mixtures thereof.

15. A premix for enriching food comprising a composition according to any one of claims 1-14, and sugar.

16. A process for preparing a composition according to any one of claims 1-14, which process comprises preparing an oil-in-water emulsion containing from 1 wt% to 40 wt% of a fat soluble substance; from 30 wt% to 85 wt% of maltose or a mixture of low-molecular weight carbohydrates optionally in combination with 0 wt% to 50 wt% of a high-molecular weight carbohydrate; from 0.1 wt% to 30 wt% of an emulsifier; and, optionally, from 0.1wt% to 15wt% of an antioxidant; and, if desired, converting this emulsion into a dry powder.

17. The use of the compositions according to any one of claims 1 to 14 for multivitamin tablets, hard gelatin capsules and dry food and feed compositions.

18. Process for preparing a premix which process comprises mixing sugar and the composition according to any one of claims 1 to 12 in form of a dry powder in a ratio of about 14 to 1 to about 4 to 1.

19. Process according to claim 18, whereby the sugar is wetted before being added to the dry powder by adding a small amount of a saturated sucrose solution or of water.

20. Process according to claim 18 or 19, whereby an anticaking agent is added, preferably in an amount of 0.2 wt% to 2 wt%.

21. Process according to claim 20, wherein the anticaking agent is silicic acid or silicate.

Patentansprüche

1. Zusammensetzung enthaltend in Gew.-% bezogen auf das Gesamtgewicht der Zusammensetzung
1 bis 40 Gew.-% einer fettlöslichen Substanz verkapselt in einer Kohlenhydratmatrix, die aus Maltose oder Maltosesirup oder einer Mischung von Kohlenhydraten mit niedrigem Molekulargewicht, gegebenenfalls in Kombina-

tion mit einem Kohlenhydrat mit hohem Molekulargewicht, aufgebaut ist;
0,1 bis 30 Gew.-% eines Emulgators und gegebenenfalls
0,1 bis 15 Gew.-% eines Antioxidans.

2. Zusammensetzung nach Anspruch 1, wobei die Kohlenhydratmatrix aus einer Mischung von Kohlenhydraten mit niedrigem Molekulargewicht in Kombination mit einem Kohlenhydrat mit hohem Molekulargewicht aufgebaut ist.

3. Zusammensetzung nach Anspruch 1 oder Anspruch 2, wobei die Kohlenhydrate mit niedrigem Molekulargewicht ausgewählt sind aus der Gruppe bestehend aus Fructose, Glucose, Glucosesirup, Saccharose, Lactose, Dextrose, Maltose, Feststoff (Sirup) mit hohem Maltoseanteil, der über 50 Gew.-% Maltose enthält, Xylose, Arabinose, Ribose und Zuckeralkoholen.

4. Zusammensetzung nach Anspruch 1 oder Anspruch 2, wobei die Kohlenhydrate mit niedrigem Molekulargewicht ausgewählt sind aus der Gruppe bestehend aus Fructose, Glucose, Glucosesirup, Maltose und Saccharose.

5. Zusammensetzung nach Anspruch 1, wobei die Kohlenhydratmatrix aus Maltose oder einem Feststoff (Sirup) mit hohem Maltoseanteil, der über 50 Gew.-% Maltose enthält, aufgebaut ist, in Kombination mit einem Kohlenhydrat mit hohem Molekulargewicht.

6. Zusammensetzung nach einem der Ansprüche 1 bis 5, wobei das Kohlenhydrat mit hohem Molekulargewicht Maltodextrin ist.

7. Zusammensetzung nach einem der Ansprüche 1 bis 6, wobei die fettlösliche Substanz ein fettlösliches Vitamin ist ausgewählt aus der Gruppe bestehend aus den Vitaminen A, E, D und K und Derivaten davon, einem Carotinoid, einer mehrfach ungesättigten Fettsäure ebenso wie Mischungen davon.

8. Zusammensetzung nach Anspruch 7, wobei das Vitamin-A-Derivat Vitamin-A-acetat oder Vitamin-A-palmitat ist.

9. Zusammensetzung nach Anspruch 7, wobei das Carotinoid ausgewählt ist aus der Gruppe bestehend aus β-Carotin, Astaxanthin, Apocarotinal, Canthaxanthin, Apoester, Citranaxanthin und Zeaxanthin.

10. Zusammensetzung nach Anspruch 7, wobei die mehrfach ungesättigte Fettsäure ausgewählt ist aus der Gruppe bestehend aus Arachidonsäure (AA), Docosahexaensäure (DHA) oder Eicosapentaensäure (EPA).

11. Zusammensetzung nach einem der Ansprüche 1 bis 10, enthaltend 30 bis 95 Gew.-%, bevorzugt 50 bis 85 Gew.-%, bevorzugter etwa 70 Gew.-% eines Kohlenhydrats mit niedrigem Molekulargewicht.

12. Zusammensetzung nach einem der Ansprüche 1 bis 11, enthaltend 0 bis 50 Gew.-%, bevorzugt 10 bis 40 Gew.-%, bevorzugter etwa 30 Gew.-% eines Kohlenhydrats mit hohem Molekulargewicht.

13. Zusammensetzung nach einem der Ansprüche 1 bis 12, wobei der Emulgator ein Polyoxyethylensorbitanfettsäureester, eine chemisch modifizierte Stärke oder Ascorbylpalmitat ist.

14. Zusammensetzung nach einem der Ansprüche 1 bis 13, wobei das Antioxidans ausgewählt ist aus der Gruppe bestehend aus Natriumascorbat, Ascorbylpalmitat, d1-α-Tocopherol, gemischten Tocopherolen, Lecithin und Mischungen davon.

15. Vormischung zur Anreicherung von Lebensmitteln, enthaltend eine Zusammensetzung nach einem der Ansprüche 1 bis 14 und Zucker.

16. Verfahren zur Herstellung einer Zusammensetzung nach einem der Ansprüche 1 bis 14, wobei das Verfahren beinhaltet, dass eine Öl-in-Wasser-Emulsion hergestellt wird, die 1 bis 40 Gew.-% einer fettlöslichen Substanz; 30 bis 85 Gew.-% Maltose oder eine Mischung von Kohlenhydraten mit niedrigem Molekulargewicht, gegebenenfalls in Kombination mit 0 bis 50 Gew.-% eines Kohlenhydrats mit hohem Molekulargewicht; 0,1 bis 30 Gew.-% eines Emulgators und gegebenenfalls 0,1 bis 15 Gew.-% eines Antioxidans enthält, und, falls erwünscht, diese Emulsion in ein Trockenpulver umgewandelt wird.

17. Verwendung der Zusammensetzung nach einem der Ansprüche 1 bis 14 für Multivitamintabletten, Hartgelatine-

kapseln und Trockenlebensmittel- und Trockenfutterzusammensetzungen.

18. Verfahren zur Herstellung einer Vormischung, wobei das Verfahren beinhaltet, dass Zucker und die Zusammensetzung nach einem der Ansprüche 1 bis 12 in Form eines Trockenpulvers in einem Verhältnis von etwa 14:1 bis etwa 4:1 vermischt werden.

19. Verfahren nach Anspruch 18, wobei der Zucker angefeuchtet wird, bevor er dem Trockenpulver zugegeben wird, indem eine geringe Menge einer gesättigten Saccharoselösung oder Wasser zugegeben wird.

20. Verfahren nach Anspruch 18 oder Anspruch 19, wobei ein Trennmittel zugegeben wird, bevorzugt in einer Menge von 0,2 bis 2 Gew.-%.

21. Verfahren nach Anspruch 20, wobei das Trennmittel Kieselsäure oder Silicat ist.

Revendications

1. Composition comprenant en pourcentages en poids basé sur le poids total de la composition
de 1 % en poids à 40 % en poids d'une substance soluble dans la graisse encapsulée dans une matrice de glucides composée de maltose ou de sirop de maltose, ou d'un mélange de glucides à faible poids moléculaire, facultativement associé à un glucide à poids moléculaire élevé ;
de 0,1 % en poids à 30 % en poids d'un émulsifiant ; et, facultativement,
de 0,1 % en poids à 15 % en poids d'un antioxydant.

2. Composition selon la revendication 1, dans laquelle la matrice de glucides est composée d'un mélange de glucides à faible poids moléculaire associé à un glucide à poids moléculaire élevé.

3. Composition selon la revendication 1 ou 2, dans laquelle les glucides à faible poids moléculaire sont choisis dans le groupe constitué par le fructose, le glucose, le sirop de glucose, le saccharose, le lactose, le dextrose, le maltose, le corps solide (sirop) à maltose élevé qui contient plus de 50 % en poids de maltose, le xylose, l'arabinose, le ribose et les alcools glucidiques.

4. Composition selon la revendication 1 ou 2, dans laquelle les glucides à faible poids moléculaire sont choisis dans le groupe constitué par le fructose, le glucose, le sirop de glucose, le maltose et le saccharose.

5. Composition selon la revendication 1, dans laquelle la matrice de glucides est composée de maltose ou de corps solide (sirop) à maltose élevé qui contient plus de 50 % en poids de maltose, associé à un glucide à poids moléculaire élevé.

6. Composition selon l'une quelconque des revendications 1 à 5, dans laquelle le glucide à poids moléculaire élevé est la maltodextrine.

7. Composition selon l'une quelconque des revendications 1 à 6, dans laquelle la substance soluble dans la graisse est une vitamine liposoluble choisie dans le groupe constitué par les vitamines A, E, D et K et leurs dérivés, un caroténoïde, un acide gras polyinsaturé ainsi que leurs mélanges.

8. Composition selon la revendication 7, dans laquelle le dérivé de la vitamine A est l'acétate de vitamine A ou le palmitate de vitamine A.

9. Composition selon la revendication 7, dans laquelle le caroténoïde est choisi dans le groupe constitué par le bêta-carotène, l'astaxanthine, l'apocarotène, la canthaxanthine, l'apoester, la citranaxanthine et la zéaxanthine.

10. Composition selon la revendication 7, dans laquelle l'acide gras polyinsaturé est choisi dans le groupe constitué par l'acide arachidonique (AA), l'acide docosahexanoïque (DHA) ou l'acide eicosapentanoïque (EPA).

11. Composition selon l'une quelconque des revendications 1 à 10, comprenant de 30 % en poids à 95 % en poids, de préférence de
50 % en poids à 85 % en poids, de manière préférée environ

70 % en poids de glucide à faible poids moléculaire.

12. Composition selon l'une quelconque des revendications 1 à 11, comprenant de 0 % en poids à 50 % en poids, de préférence de 10 % en poids à 40 % en poids, de manière préférée environ 30 % en poids de glucide à poids moléculaire élevé.

13. Composition selon l'une quelconque des revendications 1 à 12, dans laquelle l'émulsifiant est un ester d'acide gras poly-oxyéthylène-sorbitan, un amidon traité chimiquement ou un palmitate d'ascorbyle.

14. Composition selon l'une quelconque des revendications 1 à 13, dans laquelle l'antioxydant est choisi dans le groupe constitué par l'ascorbate de sodium, le palmitate d'ascorbyle, le de-alpha tocophérol, les tocophérols mélangés, la lécithine et ses mélanges.

15. Pré-mélange pour enrichir les aliments comprenant une composition selon l'une quelconque des revendications 1 à 14, et du sucre.

16. Processus pour préparer une composition selon l'une quelconque des revendications 1 à 14, lequel processus comprend la préparation d'une émulsion huile-dans-l'eau qui contient de 1 % en poids à 40 % en poids d'une substance soluble dans la graisse ; de 30 % en poids à 85 % en poids de maltose ou d'un mélange de glucides à faible poids moléculaire facultativement associé à 0 % à 50 % en poids d'un glucide à poids moléculaire élevé ; de 0,1 % en poids à 30 % en poids d'un émulsifiant ; et, facultativement, de 0,1 % en poids à 15 % en poids d'un antioxydant ; et, s'il est souhaité, convertir l'émulsion en une poudre sèche.

17. Utilisation de la composition selon l'une quelconque des revendications 1 à 14 pour des comprimés de multivitamines, des capsules de gélatine dure, et des compositions alimentaires déshydratées.

18. Processus pour préparer un pré-mélange, lequel processus comprend le mélange du sucre et de la composition selon l'une quelconque des revendications 1 à 12 sous la forme d'une poudre sèche dans un rapport allant d'environ 14 à 1 à environ 4 à 1.

19. Processus selon la revendication 18, dans lequel le sucre est humidifié avant d'être ajouté à la poudre sèche en ajoutant une légère quantité d'une solution de saccharose saturée ou d'eau.

20. Processus selon la revendication 18 ou 19, dans lequel un agent antiagglomérant est ajouté, de préférence à une quantité allant de 0,2 % en poids à 2 % en poids.

21. Processus selon la revendication 20, dans lequel l'agent antiagglomérant est l'acide silicique ou le silicate.